

### **Activity 9.1 – Exploring the NetLogo Model Ecosystem**

#### **Connections:**

You have been investigating why the trout population changing. In Lesson #6 you learned that an invasive species entered the Great Lakes ecosystem and that it might be affecting the trout. Do you think that one new population could cause the trout population to decrease this much?

In this lesson you will learn explore ways that one new population could cause a native population to change. You will begin by exploring the computer model of an ecosystem, learning how the native organisms relate to one another. This will prepare you to explore adding a new population to the ecosystem.

#### **Purpose:**

In this activity you will explore the NetLogo model in order to learn how organisms can affect one another.

#### **Directions:**

1. Open model: L9\_Model\_9.1.nlogo
2. Explore the model, see what happens when you change the slider values. What do you think the sliders mean?
  - a. While exploring the model note that any changes you make to the sliders have to be made **before** you press the SETUP button.
  - b. You **must** press the SETUP button **before** you press the GO button. If you do this out of order you will get an error.
  - c. If you get an error, press “Discard” and try again.
3. After you have explore the model, answer the following questions:

#### **Conclusions**

1. Draw a food chain to show the relationships between the foxes, rabbits and grass.

2. Which organisms in the NetLogo model are in a direct relationship?
3. Which organisms in the NetLogo model are in an indirect relationship?
4. Did the rabbit population every die out for you and your partner?
5. What might make the rabbits die out?

**Follow-up Questions:**

1. How could you change the slider values to help the rabbit population survive?
2. Why would this solution help?

### Activity 9.2 – Can all Three Populations Survive?

#### **Connections:**

In the previous activity you explored the NetLogo model and learned about competition. Competition occurs when there is not enough of an important resource, like food, for the population to survive. Individuals in the population *compete* for the resource and those that do not get it die.

#### **Purpose:**

In this activity, your goal is to use what you learned in Activity 9.1 to make a stable graph. Can you find the right slider values to allow all three populations survive?

#### **Directions:**

1. Draw a picture of a stable graph.



2. Open model: L9\_Model\_9.1.nlogo.
3. Try different settings for the variables in the model until you find the right settings to allow all three populations to survive for at least 500 years.
4. Some hints:
  - a. Change the variables systematically, changing one at a time. This can help you figure out how the different variables affect the ecosystem.
  - b. Think about competition: do all of the organisms have enough resources?

#### **Conclusions:**

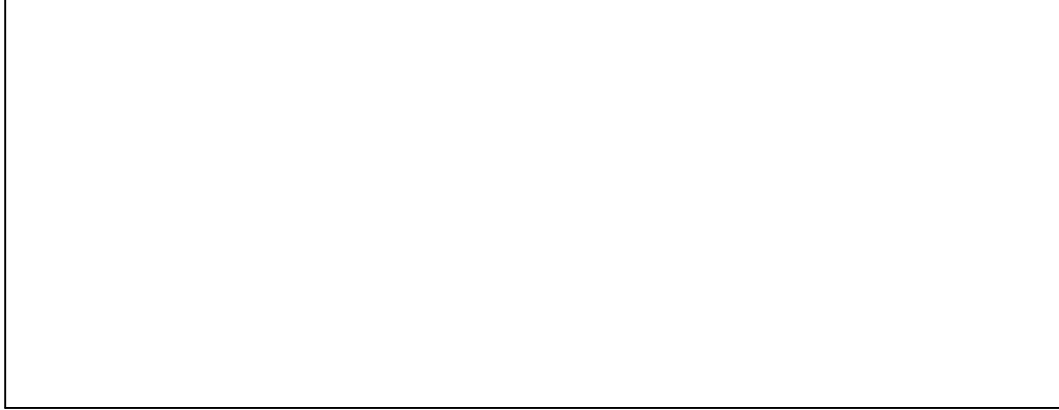
Record your final settings in the chart below.

Slider	Value
Initial-number-rabbits	
Initial-number-foxes	
Percent-grass	

How long did the model run with these settings? \_\_\_\_ years

**Follow-up Questions**

1. Imagine a food web with sheep that eat grass, and wolves that eat sheep. Using a line graph, draw what you think the graph would look like if all three populations survived. (make sure to label which lines are the sheep, wolves and grass)



### **Activity 9.3 – What does the Invader Eat?**

**Connections:**

In the previous activities you worked with a model of an ecosystem that contains foxes, rabbits and grass. In this activity you will add an invader to the ecosystem to see how a new species affects the native populations.

**Purpose:**

You and your class will work with Model 14.3 to determine what the new, unknown invasive species eats.

**Directions:**

1. In pairs:
  - a. Open Model: L9\_Model\_9.3.nlogo.
  - b. Using the settings from your table in Activity 9.2, create a stable graph.
  - c. Add the invader.
  - d. Explore the new relationships between the organisms, trying to determine what the invader eats.
  - e. As you explore the model record the results of model runs that help you decide what the invader eats. You will use this data as evidence to convince your classmates of your claim.

### Data Collection

If anything interesting happens when you work with the model, record what happened and the settings that made it occur.

You will use this information to help convince your classmates about what the invader eats.

<b>What happened?</b>	<b>Settings:</b> Percent-grass: _____ Initial-number-rabbits: _____ Initial-number-foxes: _____ Initial-number-invaders: _____ How-much-invader-eats: _____
<b>What happened?</b>	<b>Settings:</b> Percent-grass: _____ Initial-number-rabbits: _____ Initial-number-foxes: _____ Initial-number-invaders: _____ How-much-invader-eats: _____
<b>What happened?</b>	<b>Settings:</b> Percent-grass: _____ Initial-number-rabbits: _____ Initial-number-foxes: _____ Initial-number-invaders: _____ How-much-invader-eats: _____

### Conclusions:

1. **Claim:** What do you think the invader eats?
2. What **evidence** from the model supports your claim?

After you and your partner develop a claim about what the invader eats you will join another pair and come up with one claim that is supported with the evidence.

**In groups of 4:**

1. Compare your solutions to step #1.
  - a. Do you agree with the other group's claim? Why or why not?  
\_\_\_\_\_  
\_\_\_\_\_
  - b. Did the other group support their claim with good evidence? Why or why not?  
\_\_\_\_\_  
\_\_\_\_\_
2. Discuss your different solutions and the evidence you are using to support them.
3. Using your experiences with the NetLogo model, determine one solution on which you all agree. Support this claim with evidence from the NetLogo model.
4. If necessary, return to Model L9\_Model\_9.2.nlogo to test your claims and evidence. You can use the settings you collected during data collection to demonstrate a big idea to your teammates.
5. Record your final answer in the space below. This is the answer you will present to your class. Make sure it is well supported so that you can convince your classmates.

**Claim:** We think the invader eats \_\_\_\_\_

**Evidence:** We think this because we saw \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ in the model.

**Reasoning:** The evidence supports the claim because \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

After all the groups of 4 have their answers the whole class will compare answers and try to agree on one claim that is supported with evidence and reasoning.

**Whole Class Presentations:**

**Purpose:** The whole class will try to agree on what the invader eats.

**When you are presenting your answer, make sure to support it.** Can you change the minds of your classmates?

**When you are listening, consider whether you agree** with your classmates' claims and evidence.

**Directions:**

1. During the presentation, classmates may ask the presenters questions in order to determine whether they agree with the claim and evidence. Whether or not you agree depends on how well the presenter supported the claim with evidence. A well supported presentation will:
  - a. Clearly state a claim about what the invader eats.
  - b. Provide evidence that is related to the claim.
  - c. Present evidence based on observations of the computer model not opinions.
  - d. Explain all of the evidence observed in the model.
  - e. Uses scientific principles to support the claim.
2. As a class, determine what you think the invader eats. Did anyone present evidence that made you change your mind?



**Write a convincing scientific explanation** about what the invader eats and how you know. *Remember, to be convincing, scientific explanations must contain a claim, evidence and a scientific principle that describes the connection between the claim and evidence.*

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Draw a picture of the graph you saw in the NetLogo model, after the invader entered.



## Activity 9.3 Homework

*Dear Family Member,*

*We have been exploring a computer model of an ecosystem. At first, this ecosystem contained foxes, rabbits and grass. We figured out how to make this ecosystem stable so that all three populations could survive. We then added an unknown organism and tried to figure out what it ate. We debated this a lot in class and had a difficult time coming to agreement. We are excited to share this experience with our family members to see whether we can convince them that we figured out what this unknown organism eats.*

*Thank you!*

### Student Questions

1. Discuss your explanation and graph with your family member or other adult.
2. What questions did your family member ask you about your experience?
3. Were you able to convince your family member that your claim was true?
4. Please have your family member sign below.